Measures for avoidance and extermination of flies, mosquitoes, lice and other vermin / by H. Maxwell-Lefroy.

This short pamphlet of simple instructions for avoiding the attacks of disease-carrying insects and for their extermination is not meant in any way to interfere with official efforts in this direction, but is a response to numerous enquiries from doctors, nurses and other volunteer workers as to how they may protect themselves and those under their charge from the diseases carried by flies, vermin, etc.

MEASURES

FOR

AVOIDANCE AND EXTERMINATION

OF

FLIES, MOSQUITOES, LICE

AND OTHER VERMIN.

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PREFACE TO THE FIRST EDITION.

AN attempt has been made below to put together, as briefly as possible, information on the most trustworthy methods of avoiding and destroying flies, mosquitoes, lice and other vermin, for the benefit of those who are fighting the diseases transmitted by these insects. It is impossible to state exactly what course should be adopted to exterminate these pests without a knowledge of what materials are available in each locality. The methods described have been proved useful elsewhere, and doubtless could be adapted to local needs and to local resources; they are set forth here in the hope that they may prove of practical help to those engaged in the problem of exterminating vermin of various kinds The aim is strictly practical and no attempt has been made to obtain scientific completeness. I wish to thank Dr. Harriette Chick, of the Lister Institute, for help in drawing up the following suggestions; Professor J. L. Todd, of Montreal, for valuable suggestions in connection with the paragraphs on mosquitoes, and Miss Rhodes for making the drawings.

The types of vermin dealt with are:— (1) Lice, (2) Flies, (3) Mosquitoes, (4) Fleas, and (5) Bed-bugs.

For purposes of convenience, formulæ of the insecticides mentioned in the text will be found collected at the end of the paper.

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May 1915.

PREFACE TO THE SECOND EDITION.

Since coming to India, I have found that the new methods used in the army in France and the Mediterranean are not known in India, as most of them were devised only during the latter half of 1915. This edition has accordingly been printed both in order to bring it up to date and to add matter specially applicable to India.

In preparing this edition I have used information gained from medical officers from the front and from the entomologists who worked with the British Expeditionary Force, notably Professor Newstead and Mr. Jack. The four new methods described here are the result of investigations, carried on at the Imperial College of Science and Technology, South Kensington, under my direction.

Attention is particularly directed to page 10 and the spray method there described.

H. MAXWELL-LEFROY,

Delhi, April 1916.

MEASURES FOR AVOIDANCE AND EXTERMINATION OF FLIES, MOSQUITOES, LICE AND OTHER VERMIN.

Lice.—Lice live in clothing and bedding and are never far removed from their hosts. They are delicate creatures and require to feed at frequent intervals. For this reason the problems of the extermination of lice resolve themselves into the question of efficient cleansing of the person and clothing.

In recent years lice have acquired a special importance as a particularly dangerous form of vermin, owing to the growing conviction that the spread of typhus fever is effected solely by these insects. It has also been proved that relapsing fever can be transmitted by lice. There is also evidence that the virus of typhus fever can be transmitted by lice through the egg to their offspring; for this reason all measures directed against the louse, on grounds of infection, should be extended also to the egg.

Vermin were excessively abundant in the British Expeditionary Force in 1914-15, but as no cases of typhus occurred, they could not spread it: the very greatest care is taken to isolate prisoners who might have typhus. At the commencement of the war, the Serbian army had vermin but no typhus, but the latter broke out extensively after the recapture of Belgrade when Austrian typhus cases were found in hospitals there.

Clearly it is of the first importance not only to isolate typhus cases but to make sure that there are not the vermin to carry the disease if it occurs.

Vermin were a cause of persistent sleeplessness and irritation, a contributing factor to ultimate nervous breakdown: they occur mainly in cold climates where, under war conditions, baths and changes of clothes are not

frequent, where much clothing is worn and where there are no opportunities to remove clothing and search it for vermin and eggs.

The importance of de-verminising infected troops is now recognized more fully than before the war.

Heavy mineral-oil emulsion, a soap-hydrocarbon emulsion so prepared as to be perfectly miscible with water, has been found a trustworthy insecticide for lice. As it contains a considerable proportion (30 per cent., see below) of soft soap it can be used for washing purposes. The following measures are appended for the avoidance and extermination of lice, and for the use of crude-oil emulsion :—

1. The form of crude-oil emulsion described below has been adopted by the Army Medical Corps under the name *Vermijelli*, to be used with the *N.C.I.* powder devised by Major Lelean, R.A.M.C. (formula below) The official ration is two-thirds of an ounce of each per man per week and both are issued in the ordinary way.

When exposed to lice, protection can be obtained by smearing the skin with a small amount of crude-oil emulsion, rubbing it in the hair, applying it in the stockings, socks, inside boots or puttees, along the seams of clothing and at the neck and wrists. It can be used as a soap when bathing, and a little rubbed on the skin afterwards.

If actually infected with vermin, rub *Vermijelli* on the hairy parts of the body and on the seams of underclothing and trousers : dust *N. C. I.* powder on the body and on the inside of under-clothing. *Vermijelli* causes a very slight amount of irritation if applied too freely to large areas of skin, owing to its interference with perspiration : it is meant for application to the hair on the body and head and for preventing eggs hatching on clothing.

It should be remembered that the experience gained with *Vermijelli* has been in a cold climate where the skin does not actively perspire : in a tropical climate, its use may require to be modified.

through a window can be caught in traps of the pattern shown below, see Fig. 2.

Description of Figure 2. **Hodge or Window Fly-trap.**—This trap, which is intended to be fitted to the lower half of a window, consists of a rectangular box with ends of wood; the sides, parallel to the aperture of the window, being made of wire gauze. This gauze, on either side, is bent to form a longitudinal pleat or fold in two places along the lines A B and C D (see Fig. 2*a*). At the apex these folds are pierced with holes half an inch in diameter, through which flies can pass into the trap (see figure 2*b*, which represents a cross-section of the trap). A shallow trough K, containing bait, is placed on the floor of the trap with a sliding adjustment. A slit, quarter of an inch in width, at the base, admits flies to the bait; the latter is covered by a piece of wire gauze, bent at an angle, at whose apex holes half an inch in diameter admit the flies into the trap. Flies entering at the bottom slit or by the side pleats, pass up in the direction of the arrows in Fig. 2*b*, and are collected in the top chamber P through the slit M. The chamber P is also made of wire gauze and can be detached at intervals in order to kill the imprisoned flies.

Description of Figure 3. **Minnesota Fly-trap.**—This trap, which is of much simpler construction than the Hodge Trap, can be made of wire gauze attached to a wooden framework. It consists of a rectangular box with sides and top of gauze, the bottom A is of wood and is interrupted along the centre by a wide longitudinal slit (B). This slit is roofed in with gauze bent at an acute angle, at whose apex is a narrow slit half an inch in width (or a series of small holes half an inch in diameter) to allow the flies to pass through into the trap; this is shown in Fig. 3*b*, which represents the trap in section. Underneath the gauze is placed the pan K containing bait. At the four corners the trap rests upon a wooden base D D leaving at the sides an open slit, a quarter of an inch in width, to admit the flies to the bait. If desirable, an upper removable fly chamber can be fitted as in the Hodge trap.

Traps of this pattern can be placed in a window or can stand in any situation in a room. Mosquito netting or muslin can be used for their construction, but a coarse wire gauze (of 8 meshes to the inch) is to be preferred, if obtainable. For the composition of suitable fly baits, see the Appendix.

6. *Flies may be cleared from a room, a hospital ward, a tent, a kitchen or any confined space by diffusing in the air small quantities of liquids which either kill or repel them. Two such liquids have been devised and are in extensive use in military hospitals and camps: both are supplied officially by the Army Medical Corps and until the requirements of the army are satisfied the formulæ are not being published. Both liquids are non-poisonous, non-inflammable and can be used without inconvenience or risk to those in the room.*

Lefroy's Solution *is the name given to the first: it is used at 1 to 2½ per cent. in water, diffused in the air: in ten minutes all flies are dead or lie paralysed on the floor. At high temperatures, a greater number recover and it is always advisable to sweep them up if possible.*

A. D. O. *is the second liquid which is similarly used but undiluted: it kills all flies it reaches and has a marked deterrent effect. As it flavours food, milk and food should be covered when the liquid is being used.*

Flies can be induced to leave a room by burning feathers, or a tablespoonful of Pyrethrum powder, (Bulgarian insect powder), or by heating cresol (or carbolic acid solution, or other coal-tar disinfectant) till it vaporises. A tablespoonful of cresol is sufficient for a moderately-sized room; in the case of carbolic acid solution the amount will depend on the strength of the solution. If the light of all windows but one, containing the trap, be temporarily dimmed, the flies will enter the trap. The trap should be baited with one of the many baits enumerated below (pp. 15 and 16). If the bait is a poisoned one, the flies will be killed and it will only be necessary to clear them out and place a fresh bait. If the bait is not poisoned the whole trap or

and a few days later is capable of reproduction. In England, the whole period from egg to egg occupies about three weeks; in warmer climates it is shorter.

There are other species of flies that breed in moist animal or vegetable matter. As a rule these are harmless, unless blood-sucking, and the aggregation of great numbers of people or the want of sanitary precautions does not contribute to their increased multiplication. It is the house-fly and the blow-fly that are of most importance in this connection.

Flies have been shown to transport the germs of Typhoid fever, Tuberculosis, Cholera, Anthrax and Plague, either attached to their feet, body and proboscis, or present in their interior or dejecta. There are grounds for supposing them to be the principal factor in the spread of Ophthalmia, Dysentery, and Infantile Diarrhœa. No fly is free from germs. Flies feed upon the liquid or semi-liquid matter contained in excrement, wounds, sputum, etc. In this way they acquire disease germs, which, on entering a house, they subsequently deposit on milk, food, persons, utensils, etc., from their feet, their proboscis, their excreta and their vomit.

To keep flies out of houses, to lessen their numbers, and to prevent the dissemination of disease by their agency, some or all of the following methods will prove useful and may be found practicable.

1. Stable or farm-yard manure should be dried, or dug into the ground; it should not be allowed to rot in a heap in the open. If this is not possible, periodical sprinkling with crude tar or mineral oil mixed with 40 times its volume of earth or sand will keep flies from laying eggs upon it or kill any eggs that may be deposited.

Borax has not been found suitable under all circumstances but Newstead finds that watering manure with borax solution hinders the pupation of the maggots. After exhaustive trial in England, the following method has been found best: a crude tar or creosote oil such as green tar oil

or neutral blast furnace oil is mixed at the rate of 1 gallon to 40 gallons of earth or sand and the mixture spread over the manure heap one inch deep, *i.e.*, 40 gallons mixture to 80 square feet of surface. Manure so treated is immune from fly-breeding and, if already infected, is rendered unsuitable to the further development of the maggots. If it is a question of dealing with manure containing no straw or litter, the oil alone may be used watered on very lightly, *i.e.*, 1 gallon to 80 to 100 square feet of surface. Crude mineral oil does not give such good results.

Where any form of crude tar or creosote oil is available, the method is cheap and simple.

Where space is available, simply spreading manure out on the soil in a layer four to six inches deep prevents fly-breeding except in warm wet weather.

If the dung heap can be spread out and dried every few days the breeding of flies will be prevented. *Flies cannot breed in dry surroundings.*

2. A manure heap can be used as a fly-trap if kept slightly moist, and encircled, to a distance of about twelve inches, by a ring of dry straw or other material for the maggots to crawl into when they are full-grown; the brown "chrysalides" must be swept up with the straw and burnt every four days, to prevent the oldest emerging as flies.

At large cavalry and remount depôts the accumulation of stable manure has been so large and continual that special methods have had to be devised. On the manure stacks, spots where flies congregate are marked with sticks and at evening the manure at these spots is taken out and burnt or treated, as it contains immense accumulations of eggs. Tins filled with dry chaff and with slits cut in the sides are sunk flush in the manure at selected spots and immense quantities of maggots go into these to pupate: the maggots that collect at the lower edges of the stack to pupate are destroyed by watering with a cresol-soap solution or other insecticides.

These are special methods which have to be devised to

eet local needs and to utilise the material that may be cally available.

3. Flies can be very much reduced *outside the house* sprinkling poisoned fluids on walls, trees, roofs, and other itable places where flies gather ; such fluids are also useful manure heaps to poison the flies which come to lay eggs, ne liquids should be syringed or sprinkled in large drops t of the reach of children or domestic animals ; if sprinkg cannot be done, bunches of grass or strips of cloth can be pped in the fluid and hung up out of reach. These methods rm a great protection for a hospital or camp and have been actised with success in Italy and elsewhere. Suitable fluids e mixtures of treacle or brown sugar with water, to which added a little sodium or potassium arsenite. This, if not tainable, may be prepared from ordinary white arsenic. ormulæ and directions are given below, p. 16).

The use of arsenical poisons has been found to be practicable in France and Flanders where the civil pulation are living in the war zone and near hospitals. ne risk of poisoning children is too great. In purely ilitary areas the method gives good results specially by nging up strips of cloth soaked in the solution.

The arsenic-treacle liquid is sold in a concentrated rm as fly-killer by Messrs Cooper and Nephews, Berkmsted.

4. Where house flies are abundant, in a house or spital ward, a solution of formalin containing some ilk (see below, p. 15) should be placed about the room in ucers containing a piece of bread, or strips of cloth, wetted ith the liquid, should be similarly distributed. Best of all, e formalin solution should be sprinkled about on the floor, bles, shelves or any ledges, in large drops for the flies to ink. This should be done overnight, or as early as posble in the morning, before the flies have had a chance to ink milk or get any other food.

A very simple fly-trap can be made with a wide mouthed ass jar by placing in the mouth a funnel made of tin, wire

gauze or of paper folded like a filter-paper with a hole at the apex: a bait must be placed in the jar, when flies will enter through the funnel and be unable to escape: a good bait is a banana, some jam or some cornflour,custard powder or similar pudding.

5. In France, the wires removed from baled hay are employed as fly papers by dipping them in the sticky liquid made of resin and oil (page 16) and hanging them up: when they are coated with flies, the wires are removed and wiped, re-dipped and replaced. A suspended wire or string is usually more attractive to flies as a resting place than any other object.

Hospital wards, kitchens, single rooms, etc., can be protected from flies by the use of traps, either placed in the windows or in the room. The efficacy of these traps depends on the fact that flies on a convex surface will not find small openings which they will readily discover if approaching them from the concave side. Thus in the diagram below, a fly will go through the opening in the direction from A to B, but not in the reverse direction, see Fig. 1. In this way (1) flies in a room may be

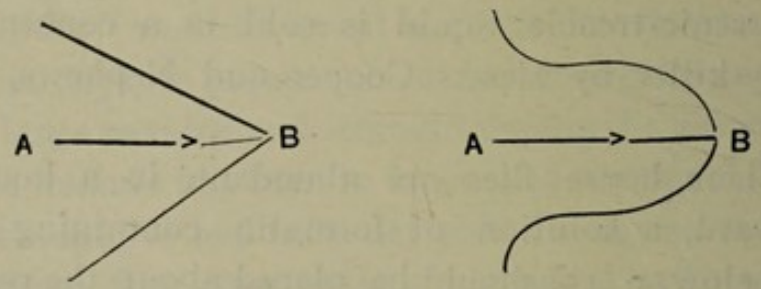

Fig. 1.

driven out and cannot re-enter if the windows are fitted with suitable screens, or (2) all flies that go out or come in

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NOTE,—This form of window trap is adapted to sash windows but can be applied to a door, a french window or a hinged window by closing in the space round the trap with wire gauze or mosquito netting. Practically any opening can be fitted with a little ingenuity.

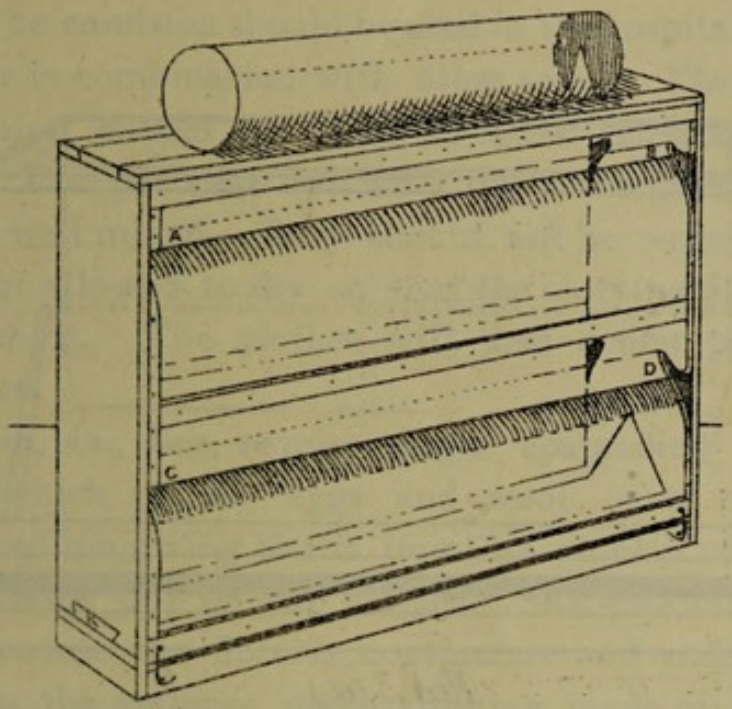

Fig. 2 (a).

HODGE FLY-TRAP.

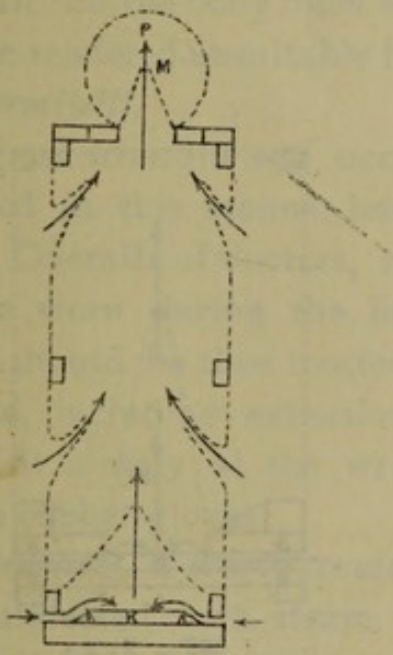

Fig. 2 (b)

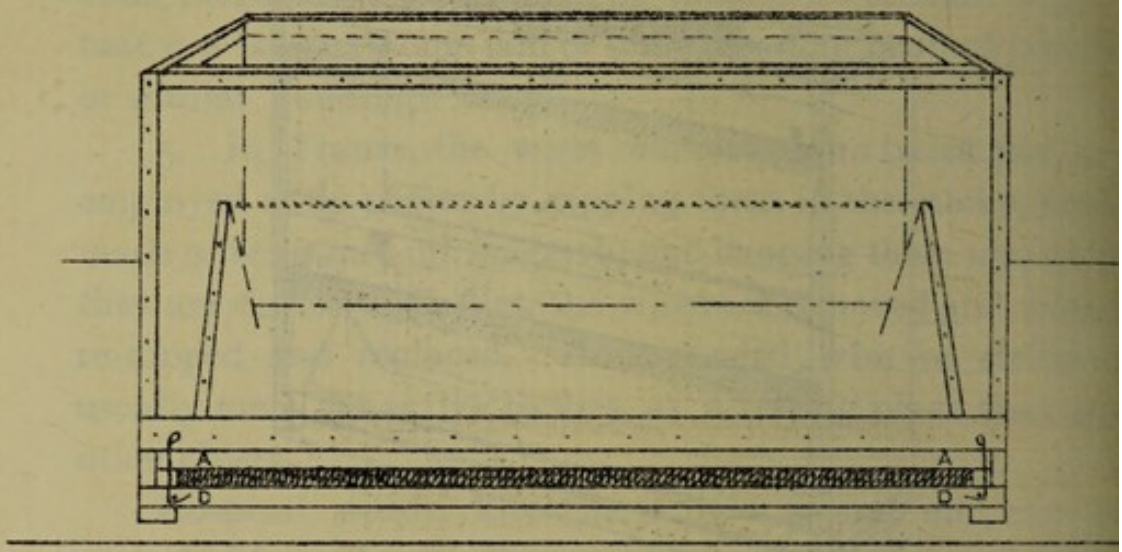

Fig. 3 (a).

MINNESOTA FLY-TRAP.

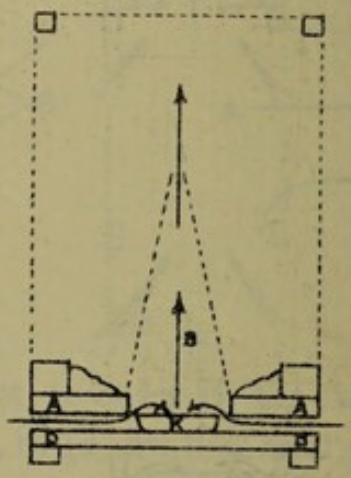

Fig. 3 (b)

2. The emulsion should be used in the hospital laundry as soap, or in combination with other soaps. The articles, after washing, should be rinsed in water containing from ½ per cent. to 2 per cent. (about 2 oz. to the gallon) of the emulsion, well mixed. They should not be wrung out too tightly, but allowed to dry so that the clothing is impregnated with it. The clothes will then confer protection against lice.

Vermin, *i.e.*, lice, require single upstanding hairs or fibres on which to lay eggs and wool offers the most suitable medium owing to the immense number of isolated fibres that stick out on the surface. Silk clothing is less suitable because the fibre is continuous and ends do not stick up on the surface: under-clothing made of real silk (not spun silk) is said to confer protection from vermin, probably on that account. As wool is so largely used in cold climates it is necessary to make it vermin-proof; the oil ingredient of *Vermijelli* by stifling the lice and preventing the eggs hatching, makes wool as safe as silk.

Obviously the hair on the body must either be removed by shaving or must be rendered unsuitable for vermin laying eggs by the use of *Vermijelli*.

Vermin hatching out from the egg upon cloth that has previously been treated in this manner has been found incapable of survival. Overalls of doctors, nurses and orderlies, especially those worn during the handling of new, uncleansed patients, should be thus treated. They should be made in one piece, including extensions to cover feet and hair, and should fit closely at the wrists. The hands can be protected with rubber gloves.

3. Verminous clothing, if worth preserving, should be boiled in water, or disinfected with steam. Pressing with a hot iron is useful, but not so efficacious. Both adult lice and the eggs are destroyed at a temperature considerably below that of boiling water. After this treatment, the clothes should be laundered in the method described under No. 2.

4. Crude-oil emulsion can be used as a soap fo scrubbing walls, floors, articles of furniture, etc. In th choice of household soaps, preference might be given t those which contain some proportion of mineral o emulsified in the soap.

5. Crude-oil emulsion, if prepared from suitable oi is not inflammable; it is non-poisonous, and it may b retained upon the skin indefinitely. After using it in th bath, the skin and hair retain sufficient of the oil to dete vermin and to given an odour of paraffin Ordinarily th is a protection, but is not enough where vermin a abundant. A little crude-oil emulsion should, in that cas be rubbed on the body after the bath, where there is reaso to fear infection through this agency.

Flies.—The flies that enter houses and carry disease a generally of two kinds:

(1) *House-flies.*

(2) *Blow-flies or Bluebottles.*

House-flies breed mainly in stable manure, when tha material is in a moist fermenting condition; they also bree in other fermenting material, such as excrement mixed wit rubbish, rotting vegetable matter, etc. Blow-flies are no usually to be found in horse manure or cow dung; the breed chiefly in animal carcases, in meat and in anima tissues generally, both in the fresh and decaying conditions

Flies lay their eggs in any situation that may b suitable for the growth and development of their young the list of materials detailed above are well adapted fo this purpose The maggot, hatching out, penetrates th material, disintegrates it and feeds upon it, and, in the cas of the blow-fly maggot particularly, immerses itself almos completely in the semi-liquid material. *The maggot-stag needs moist conditions.* After feeding for some days, th maggots leave the moist fermenting material for drie conditions; they seek a situation where they can turn int the hard, brown, seed-like, "*chrysalides*," within whic the fly develops. After a lapse of some days the fly emerge

e removeable top must be taken away and the flies killed dipping the whole in hot water or holding it over boil- g water or the fumes of paraffin oil or benzine.

7. The best way to keep down flies is to destroy their eeding places. *If possible, the most important precaution the destruction of all manure, animal carcases, refuse, etc.* hospital may be infected with flies from a single source its neighbourhood which usually can be found, dealt ith, and the flies exterminated.

8. As flies carry disease germs from one spot and posit them elsewhere upon food, etc., *the following ecautions should be insisted upon* :—

(*a*) Milk, water, food and fruit should be covered and kept in fly-screened larders or meat safes. Squares of clean muslin, light cloth or mosquito-netting with beads or shot sewn into the corners, are useful for covering glasses, jugs or other food receptacles. In the absence of fly proof larders, it may be useful to make muslin covers stretched on a light wooden frame-work. These can be fitted on tables holding milk, food, etc., to protect the latter. Care must be taken that the muslin does not touch the food.

(*b*) The access of flies to all excrement, to sputum and to wounds should be *absolutely* prevented. *This is all important, as, if the flies have not access to disease germs, they cannot carry them.* All wounded men, sick persons and young children should, for this reason, be protected from flies.

(3) **Mosquitoes.**—The role of mosquitoes in the spread malaria and yellow fever is too well-known to need mment. The bites of these insects provide the only own method by means of which these diseases are carried om person to person.

Mosquitoes breed in stagnant water, cisterns, ponds, c., and in the first instance energy should be directed to e destruction of all such in the neighbourhood of a ilding. In some cases one small breeding spot will infect

a whole place, and if this is found and destroyed the nuisance will be stopped. The following measures are recommended

1. Search must be made for the presence of ponds water butts, old cans, cisterns, badly constructed rain gutters, or other receptacles of stagnant water in the neighbourhood of a building. Such breeding places should be destroyed, or, if this is impossible, crude mineral oil (10 c.c to the square metre or one tablespoonful ($\frac{1}{2}$ oz.) to the square yard) should be poured on the surface of the water to kill the mosquito grubs. For the crude oil, heavy mineral oil (flash-point about 65°C, or 150°F) may be substituted; in either case the oil must be renewed as soon as it has evaporated, as a rule after ten days. Both petrol and burning oil (kerosene) are less suitable owing to their greater volatility; if used, they will need to be renewed much more frequently.

2. Some species of mosquitoes can be trapped in great numbers by placing in the shady corners of a room tins or boxes lined with dark cloth and having the lids open. Wooden boxes with hinged lids are very suitable for this purpose. The mosquitoes enter the boxes to sleep, and if in the middle of the day, the lid is quickly put on, the insects are trapped. To kill the mosquitoes a small quantity of any volatile substance, such as chloroform, benzine, petrol, etc., should be put in through a small hole. The box should be aired before it is set again.

The liquids referred to on p. 10 are useful against mosquitoes in the same way as against flies.

3. Mosquitoes will leave a moderately-sized room if a tablespoonful of Pyrethrum powder is burnt in it. For Pyrethrum, cresol (or carbolic acid, or other coal-tar disinfectant) can be substituted, a tablespoonful of cresol being heated till it vaporises. There should be an open window, preferably a well-lighted one, through which the insects can leave. This should be shut after about half-an-hour or screened with wire gauze, mosquito netting, etc. The room will then be free of mosquitoes until next day.

4 Citronella oil, lemongrass oil, eucalyptus oil, or

ude-oil emulsion scented with citronella, will keep osquitoes away if applied to the neck and hands. This is valuable means to apply if sleeping in a train or osquito-infected place.

5. Wherever possible, the whole building should be ade mosquito-proof by the use of screens. If this is im-ssible, *the use of the mosquito curtain* (16-18 meshes to e inch) *at night cannot be too strongly insisted upon.* The pports for the curtain must be placed outside and not side the curtain, which should be tucked underneath the attress and on no account allowed to touch the floor.

(4) **Fleas**—The transmission of Bubonic Plague by e agency of fleas has been placed beyond all doubt by e researches, among other workers, of the members of e Indian Plague Commission (1905-1909).

Fleas breed in cracks in the floor, in rubbish, in dirty rners of rooms, in dusty places, etc, The removal of all ust and the washing of such places with crude-oil nulsion or any emulsified disinfectant containing soap ill stop breeding.

Animals or persons carrying fleas can be easily cleared washing with crude-oil emulsion : it should be lathered ell on to the skin and not washed off completely.

(5) **Bed Bugs**– Bed-bugs only visit their hosts for e purpose of obtaining food ; they spend the day in chinks cracks of the bed, furniture or wall, emerging at night order to feed. Bugs are very hardy creatures and have en found by experiment capable of surviving without od for as long a period as six months.

They can be discouraged by washing bed, furniture, alls, etc., with crude-oil emulsion, taking special care of e cracks aud crannies. They can sometimes be trapped small pieces of the corrugated cardboard used for packing these are placed in the corners of rooms. The bugs creep side between the two layers of card, and sleep there. ey can be collected next day and killed in hot water. crude-oil emulsion is rubbed on the legs of the bed, d-bugs will be prevented from climbing up.

APPENDIX.

FORMULÆ AND DIRECTIONS FOR PREPARING THE VARIOUS INSECTICIDES MENTIONED IN THE TEXT.

Note.—For convenience duplicate formulæ are given, (*a*) using the metrical and (*b*) the English system of weights and measures; these formulæ contain the same proportions (not quantities) of the various ingredients.

I. CRUDE-OIL EMULSION.

Crude mineral oil (s g. 0·8)	56 grms. (70 c c.)	}	or	{ 5½ pints.
Soft soap	30 „			{ 3 lbs.
Water	about 6 c.c.			{ about ½ pint.

Heat the soft soap carefully, adding half pint of water; when hot, remove from the fire, stir in the crude mineral oil, and stir vigorously. The whole forms a jelly on cooling, which is perfectly miscible with water. Where crude mineral oil is obtainable, the above forms an efficient insecticide. All grades of mineral oil are not to be recommended, *e.g.* burning oil is not suitable.

A superior preparation is obtained by substituting for the crude mineral oil a mixture of 20 parts of (1) "Bottom oil" or grease (cracking point above 600° C), and (2) 50 parts of oil of higher boiling point and higher specific gravity than ordinary burning oil, thus:

*"Bottom" oil or grease (cracking-point above 600° C)	20 grms.			{ 2 lbs.
(Texas) Fuel oil (s.g. 0 86, b:p 200°C—350° C)	50 „	(58 c.c.)	or	{ 5 lbs (1¼ pints)
Pure soft soap	30 „			{ 3 lbs.
Water	(about) 6 c.c.			{ about ½ pint.

* A refined form of crude-oil emulsion has been prepared according to this formula and placed on the market as Vermijelli by Bowley & Sons, Wellington Works, Battersea.

A similar preparation, containing citronella, is also prepared by this firm (see above, under Mosquitoes).

In this preparation the lighter oil acts as an insecticide by contact and by the action of its vapour ; the grease on the skin or in the clothes kills by contact.

Crude Oil Emulsion has been made and sold by Messrs Bathgate, Calcutta, for several years ; a refined form is now made for human use but the oil used in Vermijelli is not available and the Calcutta product is black.

In each case the soap acts as emulsifier and renders the preparation miscible with water, so that it can be washed off any surface (skin, clothes, etc.) to which it has been applied. It also renders the insecticide non-inflammable.

N. C. I.—Major Lelean's formula for N. C. I.

Powdered Naphthalene ...	96	per cent.
Creosote	2	„ „
Iodoform	2	„ „

II. FLY POISONS.—There is a wide range of mixtures of formalin, milk and water, which are at the same time attractive and poisonous to flies. The following are typical examples :

1. To be placed in saucers containing a crust of bread sprinkled with sugar or spread with treacle.

Formalin (40% Formaldehyde)	5 c.c.	or	1 tablespoonful, =(½ fluid oz.)
Water	200 c.c.		1 pint

2. As poison for sprinkling in rooms and for traps :

(*a*)	Formalin (40% Formaldehyde)	10 c.c.	or	1 tablespoonful, =(½ fluid oz.)
	Milk	400 c.c.		1 pint
	Water	400 c.c.		1 pint
(*b*)	Formalin (40% Formaldehyde)	10 c.c.	or	½ pint
	Sugar	10 grams.		10 oz.
	Milk	30 c.c.		1½ pints
	Water	50 c.c.		2½ pints

3 For use outside, and for traps :

(*a*)	Treacle	100 grams.	or	10 lbs.
	Arsenite of soda or potash	20 „		2 lbs.
	Water	1 litre		10 gallons
(*b*)	Treacle	10 grams.	or	1 lb.
	Honey	10 „		1 lb.
	Arsenite of soda or potash	5 „		½ lb.
	Water	1 litre		10 gallons

If sodium (or potassium) arsenite ($NaAsO_2$) is not to be obtained, poison (*b*) can be prepared, using ordinary white arsenic (arsenious oxide As_2O_3) as follows :

Solution A.			Solution A.	
Arsenious oxide, As_2O_3	4 grms.	or	White arsenic	6 oz.
Sodium carbonate Na_2CO_3, anhydrous	16 „			
(or washing soda $Na_2CO_3 10H_2O$	50 „)		Washing soda	4½ lbs.
Distilled water	250 c.c.		Water	2½ gallons.
Shake and warm until dissolved, then make up to 500 c.c.			Finally make up to	5 „

Solution B.			Solution B.	
Treacle	10 grms.	or	Treacle	1 lb.
Honey	10 „		Honey	1 lb.
Water	500 c.c.		Water	5 gallons.

Solutions A and B mixed in equal amounts will yield poison (*b*).

Poison (*a*) is similarly prepared, except that the quantities for preparing solution A (with the exception of the water) are to be multiplied by 4, the honey omitted from solution B, and 10 times the quantity of treacle used.

4. Baits for fly traps :

Baits : Banana is good, also jam, milk pudding or treacle : *for blow flies* : fish, liver and meat in the order named. It is easy to collect immense numbers of blow-flies in large simple traps out of doors.

5. Fly papers can be made by boiling up resin in linseed, sesamum or other vegetable oil until it gets sticky. The proportion is usually about two parts of resin to one of oil. This is then smeared on the surface of paper.

The sticky material on fly papers can now be obtained in liquid form in tubes, ready for application to paper, string, wire or cloth ; this is a clean way of quickly making fly-papers.

In camps and under military conditions, this liquid can be sprayed on tree-trunks, buildings, walls etc. as well as on strips of cloth, ropes etc., hung in places where flies gather. Very large areas of "fly paper" can thus be quickly made in a camp or cantonment and very large quantities of flies killed.

6. To keep flies from the person when walking or riding. Assafœtida dissolved in vinegar or crude mineral oil containing cresol or other coal tar derivative should be applied to the hat or clothing.

No really good deterrent for personal application seems to exist, as flies have so little sense of smell: the best appears to be wintergreen oil or white birch oil, with *vermijelli* or grease: "Anti-fly" *vermijelli* containing winter-green can be obtained. Ordinary *vermijelli* gives relief when flies are very abundant.

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